The Egyptian Journal of Hospital Medicine (July 2025) Vol. 100, Page 4279-4283

Ultrasonic Scoring System for Prediction of the Prognosis of Placenta Accreta Spectrum

Hossam Ramadan Abdulwahab Ismail*, Ibrahim Mohamed Shahat Mohamed, Mohamed Salah El Din Fahmy, Nahla Waer El Sayed Shady, Maraey Menoufy Khalil Ali
Department of Obstetrics and Gynecology, Faculty of Medicine, Aswan University, Aswan, Egypt
***Corresponding author:** Hossam Ramadan Abdulwahab Ismail, **Email: hosamramadan@aswu.edu.eg, Tel.: +201067500221**

ABSTRACT

Background: Placenta accreta spectrum (PAS) has become one of the main life-threatening conditions in obstetrics, and accurate diagnosis is a must for proper outcome.

Purpose: To evaluate the role of an ultrasonic scoring system in prognostic assessment of placenta accreta among cases of placenta previa with previous uterine surgery.

Patients and Methods: Between May 2022 and May 2023, a total of 102 women with a prenatal suspicion of placenta accreta were recruited. Clinical data and ultrasound images were collected, and each case was evaluated using a standardized ultrasonic scoring system. The scoring items incorporated grayscale ultrasonography and color Doppler indices. Based on the total score, patients were categorized into three groups, corresponding to placenta accreta, placenta increta, or placenta percreta.

Results: Placenta scoring system showed 85% sensitivity, 88% specificity, 87.5% PPV and 85.5% NPV.

Conclusion: The placenta accreta scoring system serves as a practical and straightforward method for evaluating and predicting PAS risk, enabling obstetricians to select optimal surgical approaches that reduce intraoperative complications.

Keywords: Placenta Accreta Spectrum, Postpartum Hemorrhage, Ultrasound Scoring, Cesarean Section, Hysterectomy.

INTRODUCTION

Global cesarean section (CS) rates have increased markedly over the previous four decades, rising from less than 10% to greater than 30%. This trend has produced almost tenfold elevation in placenta accreta spectrum (PAS) incidence in several middle- and high-resource settings. As cesarean section rates continue to climb, the frequency of PAS is expected to grow further in the coming decade. Indeed, within the past ten years alone, PAS incidence has risen to approximately 3% [(1)].

Prenatal imaging should be performed with minimal risk to both mother and fetus. Ultrasonography remains the main diagnostic modality for PAS, owing to its widespread accessibility, safety, and high sensitivity. Greater clinical awareness of PAS, combined with continuous advances in imaging, has further improved diagnostic performance [(2)].

Several studies have suggested diagnostic scoring systems for PAS, integrating ultrasonographic features and/or clinical risk factors to facilitate diagnosis and predict maternal–neonatal outcomes [(3)]. However, the utility of these scoring systems has varied considerably across studies. To improve diagnostic precision and standardize interpretation, the European Working Group on Abnormally Invasive Placenta has recently advocated for the harmonization of ultrasonographic markers of PAS. These markers have been integrated into a unified framework, providing detailed definitions with a specific focus on ultrasonographic evaluation (Table 1) [(4)].

Table (1): Placenta Accreta Scoring System[(4)]

	0	1	2
Placenta position	Normal	Marginal or low lying	Incompletely or completely centralis
Placenta thickness	<3 cm	3-5 cm	>5 cm
Continuity of clear space	Continuity	Local interruption	Disappeared
Bladder line	Continuity	Local interruption	Disappeared
Lacuna	None	Present	Fused with boiling water sign
Condition of subplacental vascularity	Normal blood flow	Blood flow increased	The emergence of cross border blood vessel
Cervical hypervascularity	None	Present	Fused with boiling water sign
Morphology of cervix	Complete	Incomplete	Disappeared

Received: 30/04/2025
Accepted: 30/06/2025

PATIENTS AND METHODS

This prospective observational investigation was conducted in the Department of Obstetrics and Gynecology, Aswan University Hospital, over a one-year period from May 1, 2022, to May 30, 2023. A total of 102 women with suspected prenatal placenta accreta (PA) were enrolled.

Eligible women with placenta previa underwent both transabdominal and transvaginal ultrasonography using the Voluson® S8 ultrasound system (GE Healthcare, Chicago, Illinois, USA), with systematic assessment of the entire placenta through two-dimensional and color Doppler imaging. Eight sonographic parameters were scored: placental position, placental thickness, integrity of the hypoechoic retroplacental space, bladder–uterine interface, cervical morphology, and the presence of lacunae on grayscale imaging; and subplacental vascularity, cervical blood sinuses, and lacunar flow pattern (diffuse or focal) on color Doppler. Each feature was graded on a scale from 0 to 2 according to severity, with the cumulative score representing the extent of PA. Based on total scores, patients were stratified into three groups: N1 (≤5), indicating no PA or only PA; N2 (6–9), suggesting placenta increta (PI); and N3 (≥10), predicting placenta percreta (PP).

Intraoperative outcomes, including the volume of hemorrhage and frequency of hysterectomy, were assessed and compared among the three Gs (N1, N2, and N3).

Ethical Approval: The study received ethical approval from the Institutional Review Board (IRB) of the Faculty of Medicine, Aswan University. Individual files were maintained for all participants, and confidentiality was preserved by excluding any identifying details from the presented data. Verbal and written descriptions of the study were provided, and participation was restricted to those who gave documented informed consent. The study was carried out in compliance with the World Medical Association's Code of Ethics (Declaration of Helsinki).

Statistical analysis

Data were verified, coded, and analyzed using IBM SPSS Statistics, version 24.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics included means, standard errors, and percentages. Differences in frequency distributions across groups were assessed using the Chi-square test or the Monte Carlo exact test when appropriate. The distribution of continuous variables was examined with the Shapiro–Wilk and Kolmogorov–Smirnov tests. For comparisons across more than two groups, one-way ANOVA was applied to normally distributed data, whereas the Kruskal–Wallis test was used for non-normally distributed variables. Post hoc analyses were performed with Bonferroni correction. Diagnostic performance of the PA scoring system was evaluated using ROC analysis, with reporting of AUC, standard error (SE), and 95% CI. Diagnostic validity indices, including sensitivity, specificity, PPV, and NPV, were also calculated. Statistical significance was set at $p \leq 0.05$.

RESULTS

In table 2, a total of 102 women with suspected placenta accreta spectrum (PAS) were evaluated and stratified according to the ultrasonic scoring system into three groups: N1 (≤5 points; n = 52, 51%), N2 (6–9 points; n = 33, 32.3%), and N3 (≥10 points; n = 17, 16.7%). The mean score was significantly lower in N1 (3.9 ± 1.1) compared with N2 (7.1 ± 1.1) and N3 (11.4 ± 1.5), with $p < 0.001$.

Table (2): Obstetric characteristics of the studied groups

	N1 (I)	N2 (II)	N3 (III)	P-value
	(n = 52)	(n = 33)	(n = 17)	
Number of CS Deliveries				
No	5 (9.6%)	0 (0%)	0 (0%)	< 0.001*
One	15 (28.8%)	4 (12.1%)	0 (0%)	
Two	22 (42.3%)	12 (36.4%)	5 (29.4%)	
Three and more	10 (19.2%)	17 (51.5%)	12 (70.6%)	
Number of Abortions				
No	39 (75%)	23 (69.7%)	10 (58.8%)	= 0.778
One	11 (21.2%)	8 (24.2%)	6 (35.3%)	
Two or more	2 (3.8%)	2 (6.1%)	1 (5.9%)	
Number of D and C				
No	40 (76.9%)	23 (69.7%)	10 (58.8%)	= 0.687
One	10 (19.2%)	8 (24.2%)	6 (35.3%)	
Two or more	2 (3.9%)	2 (6.1%)	1 (5.9%)	

In table 3, Regarding intraoperative diagnosis, accreta was found in 84.6% of N1 G participants, 9.1% of N2 G and 17.6% of N3 G. Oppositely, increta was found in 5.8% of N1 G, 72.2% N2 and about 17.6% of N3 G. Also, percreta was found in 1.9% of N1 G, 3% N2 and about 52.9% of N3 G. As well, separable placenta was found in 7.7% of N1 G, 15.2% N2 and about 11.8% of N3.

Caesarean hysterectomy was done in 7 participants, none of N1 G had hysterectomy, only 6.1% (2) of N2 while 29.4% (5) of N3 participants had hysterectomy. While 17 participants had bladder injury and repair, 11 cases of N3 G, 4 cases of N2 G and 2 cases of N1 G.

Table (3): Characteristics of the placenta among the studied groups

	N1 (I) (n = 52)	**N2 (II) (n = 33)**	**N3 (III) (n = 17)**	**P-value**
Position of Placenta				
Low lying	13 (25%)	0 (0%)	0 (0%)	
Marginalis	23 (44.2%)	11 (33.3%)	0 (0%)	
Centralis	16 (30.8%)	22 (66.7%)	17 (100%)	< 0.001*
Placental Thickness (cm)				
	3.63 ± 1.1	4.85 ± 0.9	5.47 ± 1.1	< 0.001*
Continuity of Clear Space				
Continuous	37 (71.2%)	6 (18.2%)	0 (0%)	< 0.001*
Local Interruption	15 (28.8%)	20 (60.6%)	7 (41.2%)	
Disappeared	0 (0%)	7 (21.2%)	10 (58.8%)	
Bladder serosa interference				
Continuous	38 (73.1%)	11 (33.3%)	2 (11.8%)	< 0.001*
Local Interruption	14 (26.9%)	18 (54.6%)	8 (47%)	
Disappeared	0 (0%)	4 (12.1%)	7 (41.2)	
Lacuna				
None	5 (9.6%)	1 (3%)	0 (0%)	
Present	47 (90.4%)	27 (97%)	17 (100%)	< 0.001*
Separated **Fused**	47 (90.4%) 0 (0%)	22(81.8%) 5 (15.2%)	5 (29.4%) 12 (70.6%)	< 0.001*
Sub-placental Vascularity				
None	30 (57.7%)	8 (24.2%)	0 (0%)	< 0.001*
Increased	22 (42.3%)	25 (75.8%)	7 (41.2%)	
Cross Blood Vessel	0 (0%)	0 (0%)	10 (58.8%)	
Cervical Hypervascularity				
Present	1 (1.9%)	5 (15.2%)	15 (88.2%)	< 0.001*
Cervical Morphology				
Complete	52 (100%)	29 (87.9%)	5 (29.4%)	< 0.001*
Incomplete	0 (0%)	4 (12.1%)	10 (58.8%)	
Disappeared	0 (0%)	0 (0%)	2 (11.8%)	

*: Significant

Regarding the validity of placenta score for prediction of PA, the PA scoring system demonstrated strong diagnostic performance, with an AUC of 0.860 ($p < 0.001$; 95% CI: 0.780–0.941). Using a cutoff score of 5.5, the system showed a sensitivity of 85%, correctly identifying 85% of participants with PA, and a specificity of 88%, accurately classifying 88% of participants without accreta. The PPV was 87.5%, indicating the probability of correctly predicting accreta among all positive cases, while the NPV was 85.5%, reflecting the probability of correctly identifying participants without accreta among all negative cases. Overall, the scoring system achieved an accuracy of 86.5% (Figure 1).

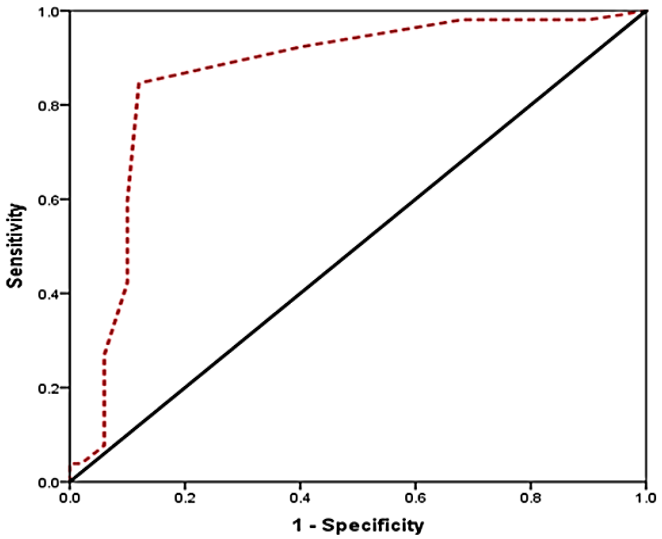

Figure 1: Showing the validity of placenta score system for prediction of placenta accreta. AUC = 0.860, p < 0.001; 95% CI: 0.780 - 0.941

DISCUSSION

PA represents a serious obstetric complication marked by abnormal trophoblastic invasion of the myometrium, which may extend as far as the uterine serosa. It is categorized into three forms based on depth of invasion: PA, PI, and PP [2,4]. Accurate diagnosis of PA has become increasingly critical due to the marked rise in its prevalence over the past two to three decades, a trend largely attributed to the growing rate of CS deliveries worldwide [5].

In this study, regarding the score type, it was N1 in 52 participants (51%), N2 in 33 participants (32.3%) and N3 in 17 participants (16.7%), while in **Chong *et al.*** study [2], there were 137 participants, 73 participants in N1with score ≤5, 36 in N2 with score 6-9, and 28 in N3 Gs with score ≥10. Also, participants in our study of N1 G had lower scores (3.9 ± 1.1) relative with those of N2 (7.1 ± 1.1, $p<0.001$) and those of N3 was (11.4 ± 1.5, $p<0.001$). This was comparable to **Ağaoğlu and Çaglar** study [6] that found mean PA scores were 2.8 ± 1.4 in the no-PAS G, 3.6 ± 1.9 in the accreta G, 5.1 ± 2.4 in the increta G, and 9.8 ± 1.6 in the percreta G.

Regarding the intraoperative diagnosis, accreta was found in 84.6% of N1 G participants, 9.1% of N2 Gs and 17.6% of N3 G. Oppositely, increta was found in 5.8% of N1 G, 72.2% N2 and about 17.6% of N3 G. Also, percreta was found in 1.9% of N1 G, 3% N2 and about 52.9% of N3 G. As well, separable placenta was found in 7.7% of N1 G, 15.2% N2 and about 11.8% of N3. Compared to **Chong *et al.***, they detected that participants in G N1, anticipated to exhibit no accreta or accreta type, included 62 cases that matched the actual pathological findings, whereas 8 cases in the N2/N3 Gs were found to have no accreta or accreta type. In the N3 G, 28 participants had scores ≥10 and were anticipated to have PP; of these, 25 cases matched the pathological findings, while 3 cases in the N1/N2 Gs were found to have percreta [2].

Comparatively, **Ağaoğlu and Çaglar** reported that among participants with PAS scores above 8, 86% had PP, and those with scores between 4 and 8 had an 82% incidence of confirmed abnormal placental invasion [6].

For the validity of this scoring system, our study revealed that the PA scoring system demonstrated a sensitivity of 85%, specificity of 88%, a PPV of 87.5%, and a NPV of 85.5%. These results are comparable to those reported by **Ağaoğlu and Çaglar**, who found that a PAS score cutoff of 4.5 yielded 60% sensitivity and 86% specificity, while a score of 7.5 provided 87.5% sensitivity and 75% specificity for differentiating PI from percreta [6]. Similarly, **Chong *et al.*** reported that a score of 4.5 achieved 81.5% sensitivity and 95.7% specificity, with prediction accuracy rates of 87.6% (64/73) in G 1 and 92.0% (25/28) in G 3. The corresponding Kappa values for accuracy of prediction were 0.75–0.77 [2]. **Zhang *et al.*** employed a similar ultrasound scoring system depending on cervical morphology and the number of before cesarean deliveries. Findings revealed that scores <3 were not associated with PAS. PA was diagnosed at scores ≥3 with 84% sensitivity and 53% specificity. PAS diagnosis required scores ≥5, corresponding to 69% sensitivity and 92% specificity. Scores ≥7 predicted PI with 58% sensitivity and 91% specificity, whereas scores ≥10 were associated with PP, with 74% sensitivity and 83% specificity [7].

In the current study, the validity of placenta score system for prediction of placenta accreta. The AUC = 0.860, $p < 0.001$; 95% CI: 0.780 - 0.941. Moreover, using 5.5 points as a cutoff, the validity criteria were as follows; 85% sensitivity i.e., PSN correctly identified 85% of positive cases as having the accreta. Also, 88% specificity i.e., placenta score correctly identified 88% of those with other types as negative. Additionally, the test had 87.5% precision -Positive Predictive Value (PPV) i.e., the ability of the test to predict accreta among all positively cases. It also had 85.5% Negative Predictive Value (NPV) i.e., the

ability to predict those without accreta among all those diagnosed as negative. Overall, the test had 86.5% accuracy.

Presently, ultrasound diagnosis is also recognized as the preferred method for placenta accreta diagnosis. The sensitivity, specificity, and positive predictive value of placenta accreta were 87%–95%, 76%–98%, and 82%–93%, respectively (D'Antonio et al., 2014; Chalubinski et al., 2013) [3,8].

Kamel et al showed that the optimal criterion value was >4.5 with Sensitivity, specificity, and positive and negative predictive values 77%, 95%, 87% and 92% respectively. So, there is high risk of placenta accreta if there is score >4.5. At this cut off point, eight cases from the nine cases with clinical evidence of placenta accreta in their study were detected [9].

Also, Ağaoğlu & ÇAĞLAR revealed that in ROC analysis to predict abnormal placental invasion, the best cut-off value of PAS score was 4.5 with 60% sensitivity and 86% specificity (Area under curve=0.829; p=0.011). PAS score 7.5 had a sensitivity of 87.5% and specificity of 75% for differentiation of increta and percreta (Area under curve=0.938; p=0.003 [6].

CONCLUSION

The PA scoring system provides obstetricians with a practical and readily applicable tool for assessing and predicting the risk of PAS, thereby supporting the selection of optimal surgical strategies to reduce intraoperative complications.

Conflict of interest: None.

Funding: None.

REFERENCES

1. **Gao X, Cai J, Han F *et al.* (2021):** Prediction of placenta accreta spectrum by a scoring system based on maternal characteristics combined with ultrasonographic features. Taiwan. J. Obstet. Gynecol., 60(6):1011-1017.
2. **Chong Y, Zhang A, Wang Y *et al.* (2018):** An ultrasonic scoring system to predict the prognosis of placenta accreta: a prospective cohort study. Medicine, 97(35):e12124.
3. **Chalubinski K, Pils S, Klein K *et al.* (2013):** Prenatal sonography can predict degree of placental invasion. Ultrasound Obstet. Gynecol., 42(5):518-524.
4. **Collins S, Ashcroft A, Braun T *et al.* (2016):** Proposal for standardized ultrasound descriptors of abnormally invasive placenta (AIP). Ultrasound Obstet. Gynecol., 47(3):271-275.
5. **Diag F, Jauniaux E, Chantraine F *et al.* (2018):** FIGO consensus guidelines on placenta accreta spectrum disorders: epidemiology. Int. J. Gynaecol. Obstet., 140(3):265-273.
6. **Ağaoğlu M, Çağlar A (2023):** A scoring system to predict the placenta accreta spectrum: a prospective study. Cukurova Med. J., 48(3):1016-1023.
7. **Zhang J, Li H, Feng D *et al.* (2023):** Ultrasound scoring system for prenatal diagnosis of placenta accreta spectrum. BMC Pregnancy Childbirth, 23(1):569.
8. **D'Antonio F, Bhide A (2014):** Ultrasound in placental disorders. Best Practice & Research Clinical Obstetrics & Gynaecology, 28(3): 429-442.
9. **Kamel H, Abd El Aal D, Nagy Elammary M, Twfik M (2021)**: Scoring Model for Prediction of Placenta Accreta Spectrum (PAS) in Early Pregnancy. Evidence Based Women's Health Journal, 11(2):170-176.